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Mazdoor Kisan Shakti Sangathan

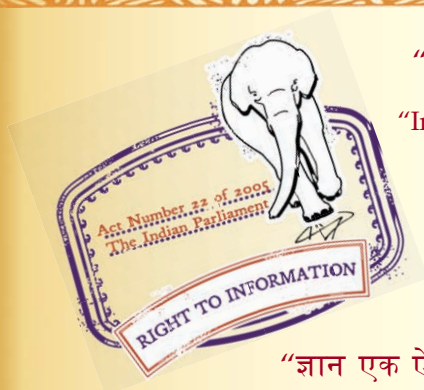
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 4774-2 (1982): Thin-walled Half Bearings, Part II:
Flanged Bearing [PGD 31: Bolts, Nuts and Fasteners
Accessories]



“ज्ञान से एक नये भारत का निर्माण”

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“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SPECIFICATION FOR
THIN-WALLED HALF BEARINGS**

PART II FLANGED BEARING

(First Revision)

1. Scope — Covers the requirements for thin-walled half flanged bearings suitable for housings, having inside diameter of 38 to 150 mm. A reference has also been made regarding the constructional features generally associated with manufacturing techniques.

2. Terminology — For the purpose of this standard, the definitions given in IS : 10260-1982 ' Terms, definitions and classifications of plain bearings : Part I Construction, Part II Friction and wear; and Part III Lubrication, shall apply.

3. Material

3.1 The compositions of lining materials and steel backing generally used for the manufacture of flanged bearings shall be as given in Appendix A and B respectively. At least one sample shall be checked from each lot for chemical composition and microstructure.

3.2 Adherence Test — In order to ensure that the bearing metal is completely and firmly bonded to the backing metal, the adherence test shall be carried out. For conducting this test, unless specified otherwise by the purchaser, at least one bearing shall be taken from each lot of 500 pieces or less. The test shall be carried out as given in 3.2.1.

3.2.1 The grooves in the bearing-metal liner parallel to the longitudinal axis of the bearing shall be cut with a chisel. The grooves shall be the full depth of the bearing metal liner and shall be spaced so as to leave lands of bearing metal approximately 6 mm wide. The chisel shall then be inserted at right angles to the bearing metal lands at the bond line and the liner cut away along the bond line. This operation shall be repeated at intervals along the lands to determine if there is any tendency for the lining to separate cleanly and as a unit from the backing metal. The inside surface of the backing metal shall be examined and any evidence of poor bonding shall be a cause for the rejection of the lot represented.

3.3 Microstructure — Microstructure shall be checked to ensure that there is no flaw in bearing material.

4. Dimensions — The basic nominal dimensions shall be as given in Table 1.

5. Tolerances

5.1 Housing Diameter — Ferrous housing shall be manufactured to H6 limits [see IS : 919 (Part I) - 1963 Recommendations for limits and fits for engineering: Part I General engineering (*first revision*)], but in the case of housings made from materials having a high coefficient of expansion, or where other factors such as housing dimensional stability are involved, the housing size may depart from H6 limits but shall always be produced in accordance with a grade 6 tolerance.

5.2 Peripheral Length (Crush) — The peripheral length shall be measured by use of the checking method given in 5.6.

Note 1 — The bearings covered by this standard are thin and flexible and their outside diameters may not be measured by conventional means.

Note 2 — It is not possible to specify the actual size of peripheral length in this standard, since it is dependent upon the precise application; for example, on factors such as housing rigidity; housing material, operating temperature, bearing material and other factors have to be taken into account. This may be determined for each individual application.

Adopted 21 June 1982

© April 1983, ISI

Gr 7

TABLE 1 HOUSING DIAMETERS, INSIDE DIAMETERS AND WALL THICKNESS
(Clause 4)

All dimensions in millimetres.

Preferred Housing Diameters D_L	Inside Diameters, for Wall Thickness						
	1.5	1.75	2.0	2.5	3.0	3.5	4.0
38	35	34.5	34				
40		36.5	36	35			
42		38.5	38	37			
45		41.5	41	40			
48		44.5	44	43			
50		46.5	46	45			
53		49.5	49	48			
56		52.5	52	51			
60		56.5	56	55			
63		59.5	59	58			
67			63	62	61		
71			67	66	65		
75			71	70	69		
80			76	75	74		
85			81	80	79		
90				85	84	83	
95				90	89	88	
100				95	94	93	
105				100	99	98	
110				105	104	103	
120				115	114	113	
125					119	118	117
130					124	123	122
140					134	133	132
150					144	143	142

5.3 Wall Thickness — The tolerance on wall thickness e_T will depend upon the surface condition of the inside diameter of bearing which is either machine finished (machined) or electroplated surface (plated). The relevant tolerances shall be as given in Table 2.

TABLE 2 WALL THICKNESS TOLERANCE
(Clause 5.3, and Fig. 2)

All dimensions in millimetres.

Housing Diameter D_L		Tolerance on e_T (e_T Max — e_T Min)	
Above	Up to and Including	Machined	Plated
—	75	0.008	0.012
75	120	0.010	0.015
120	150	0.015	0.022

Note — Slight surface depressions are acceptable on the outside diameter of the bearings, provided that they are randomly distributed. However, the measurement of wall thickness shall not be carried out in these areas.

5.4 Surface Finish

5.4.1 The surface finish in the bore shall be of roughness grade number N6 (see IS : 3073-1967 'Assessment of surface roughness').

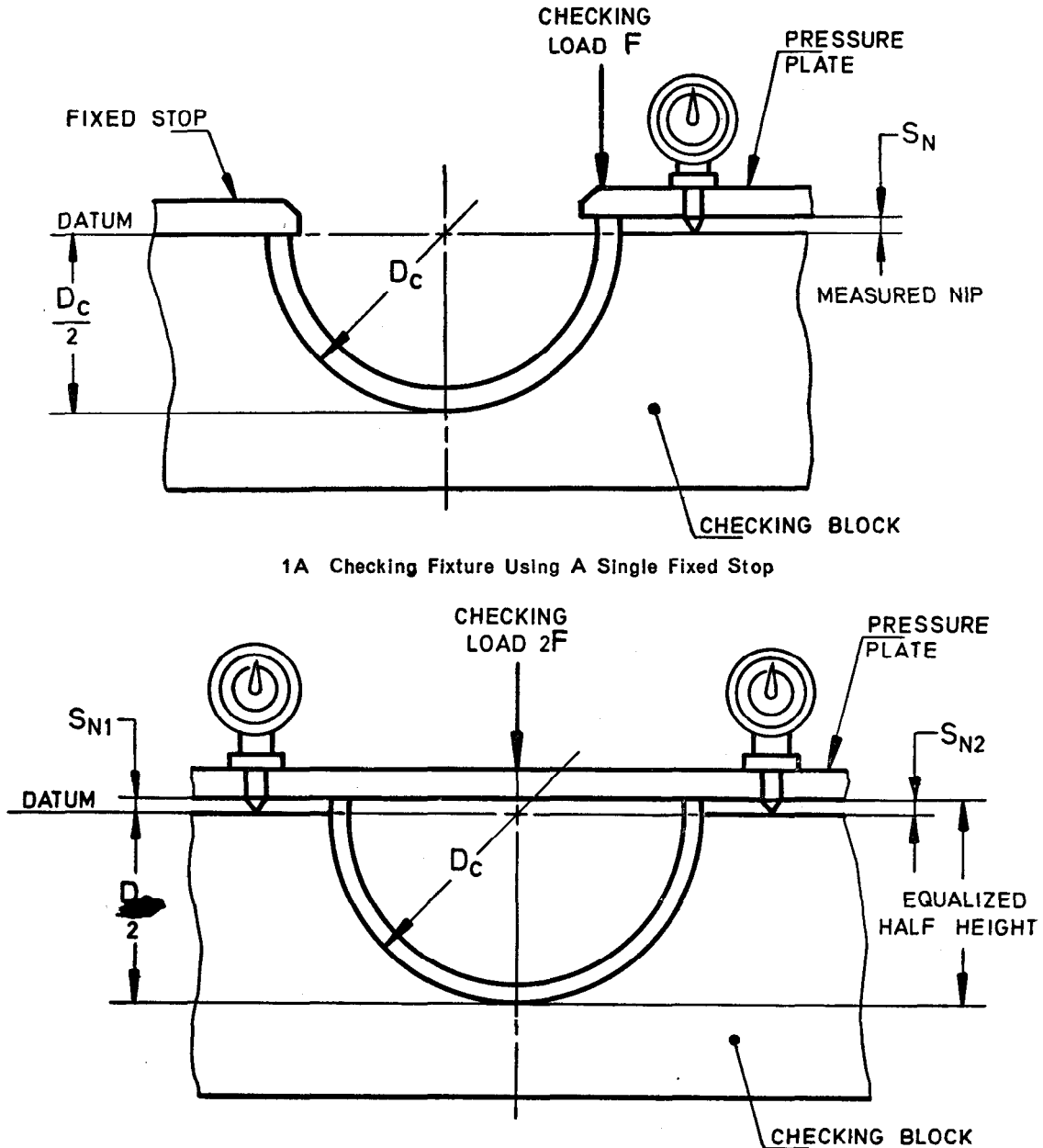
5.4.1.1 In case of overlay plated bearings, the surface finish shall be measured before plating and the limits as above shall be applied.

5.4.2 At least one bearing shall be checked for surface finish from each lot.

5.5 Journal (Shaft) — The surface finish for the journal (shaft) shall be of roughness grade number N5 (see IS : 3073-1967).

5.6 Method of Checking Peripheral Length

5.6.1 When checking the peripheral length of bearings, a typical fixture as shown in Fig. 1 is usually used with the inside diameter, D_c of the checking block equal to the maximum housing diameter of the bearing.



1A Checking Fixture Using A Single Fixed Stop

1B Checking Fixture Without Fixed Stop

(Where $S_{N1} + S_{N2} = S_N$)

FIG. 1 FIXTURE FOR CHECKING BEARING PERIPHERAL LENGTH

5.6.2 Checking load — When checking the peripheral length of bearings, the following checking loads F shall be applied to steel-backed half bearings. The tolerance limit for checking block, D_o shall be H2 grade of IS : 919 (Part I)-1963 'Recommendations for limits and fits for engineering : Part I General engineering (first revision)' :

$$F = 100 \times L \times e_T$$

where

F is the checking load, in Newtons;

L is the nominal bearing width in millimetres; and

e_T is the equivalent bearing thickness in millimetres.

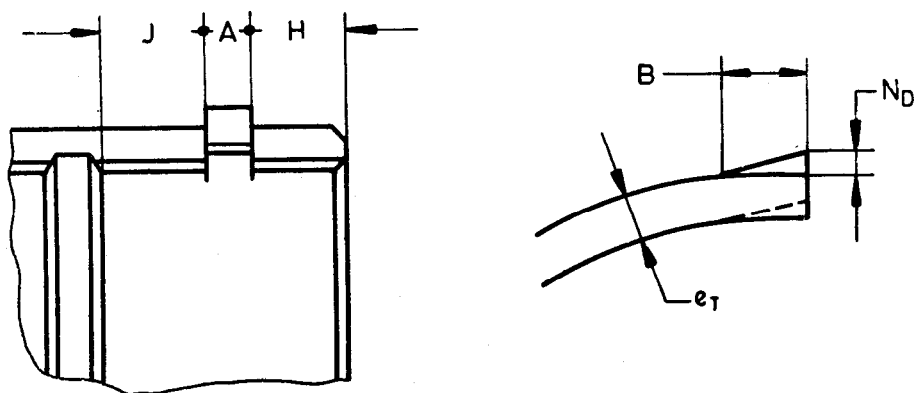
Note 1 — The checking load F shall be rounded to the nearest 500 N.

Note 2 — The checking load is limited to a maximum of 100,000 N but may be reduced according to fixture used.

Note 3 — For backing materials other than steel, and for mono-metal bearings, the checking load is to be agreed between the purchaser and the manufacturer.

6. Constructional Features and Tolerances

6.1 Locating Nicks and Notch Recesses — When nicks are used for location, the dimensions and tolerances of the locating nicks and the notches in the housing shall be as given in Tables 3 to 5 read with Fig. 2 and 3.



H — The nick may be produced at the end of the bearing, in which case $H = 0$.
Otherwise, $H \geq 1.5 \times e_T$, but shall be not less than 3 mm.

J — The nick shall be permitted to break into the groove, in which case $J = 0$. Otherwise, $J \geq 2$ mm.

FIG. 2 LOCATING NICK

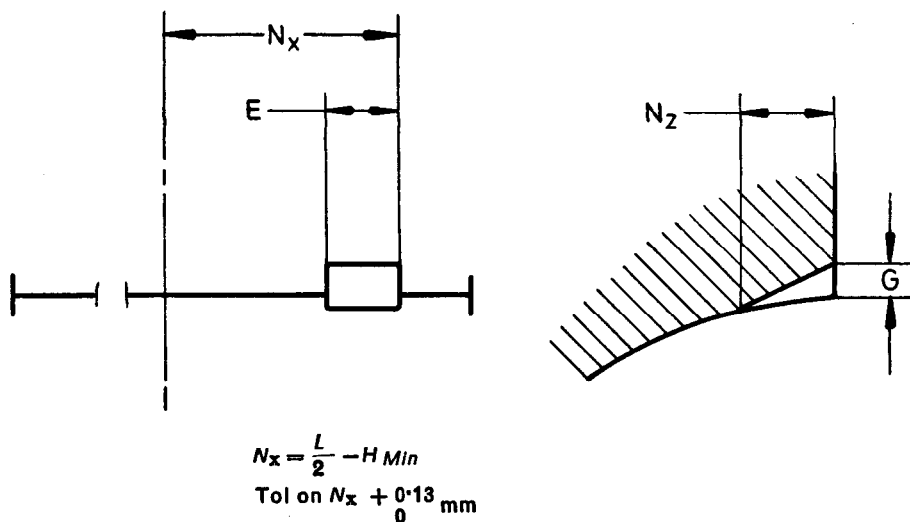


FIG. 3 NOTCH IN HOUSINGS

TABLE 3 DIMENSIONS FOR LOCATING NICK

(Clause 6.1, and Fig. 2)

All dimensions in millimetres.

Housing Diameter D_L		A	B	N_D
Above	Up to and Including			
—	38	2.72 to 2.84	3.0 to 4.0	0.8 to 1.1
38	63	3.72 to 3.84	5.0 to 6.0	1.0 to 1.3
63	85	4.67 to 4.81	5.0 to 6.0	1.2 to 1.5
85	120	5.67 to 5.81	6.0 to 7.0	1.4 to 1.7
120	150	7.61 to 7.77	8.5 to 10.0	1.5 to 2.0

TABLE 4 TOLERANCE ON DIMENSION H

(Clause 6.1, and Fig. 2)

All dimensions in millimetres.

Housing Diameter D_L		Tolerance on H
Above	Up to and Including	
—	120	+ 0.15 0
120	150	+ 0.20 0

TABLE 5 DIMENSIONS FOR NOTCH IN HOUSING

(Clause 6.1, and Fig. 3)

All dimensions in millimetres.

Housing Diameter D_L		E	N_z	G
Above	Up to and Including			
—	38	3.06 to 2.94	5.5 to 4.5	1.75 to 1.50
38	63	4.06 to 3.94	8.5 to 7.0	2.15 to 1.75
63	85	5.07 to 4.93	10.0 to 8.0	2.61 to 2.00
85	120	6.07 to 5.93	12.0 to 9.0	3.00 to 2.25
120	150	8.08 to 7.92	15.5 to 12.0	4.00 to 3.00

6.2 Joint Face Bore Relief — Joint face bore reliefs are usually provided in thin-walled half bearings, although they may be omitted in certain cases of bearings for oblique split connecting rods.

6.2.1 Joint face bore relief is provided at both sides of thin-walled half bearings along the entire width. The relevant dimensions shall be as given in Table 6 and read with Fig. 4.

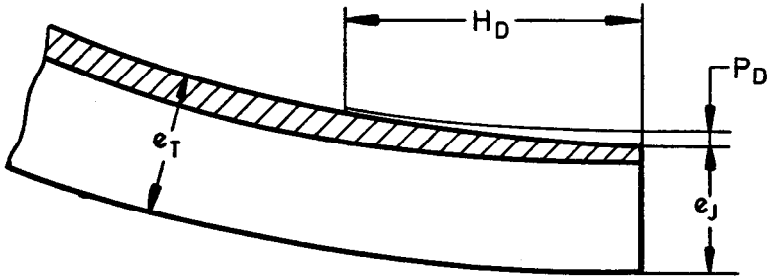


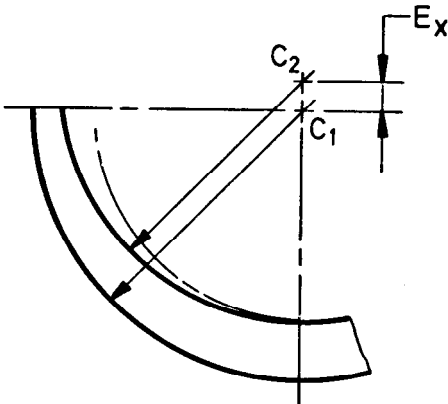
FIG. 4 JOINT FACE BORE RELIEF

TABLE 6 DIMENSIONS AND TOLERANCE FOR RELIEF
(Clauses 6.2.1 and Fig. 4)
All dimensions in millimetres.

Housing Diameter D_L		Tolerance on H_D	$P_D = e_T - e_J$
Above	Up to and Including		
—	38	0 - 2	0.025 to 0.012
38	63	0 - 3	
63	85	0 - 3	
85	120	0 - 4	0.030 to 0.015
120	150	0 - 5	0.040 to 0.020

6.2.2 For guidance, it is suggested that dimensions H_D be 1/7 of the bore diameter, but the actual value of this dimension will be dependent upon the application and shall be subject to agreement between the user and the manufacturer.

6.3 Eccentric Bores — In certain applications, it may be necessary to use bearings having eccentric bores, that is, the wall thickness of the bearing decreases uniformly from the crown to the joint faces (see Fig. 5).



Note 1 — Eccentricity E_x — It is characterized in a radial plane by the distance between the centre C_1 of the bearing outside surface and the centre C_2 of the bearing bore.

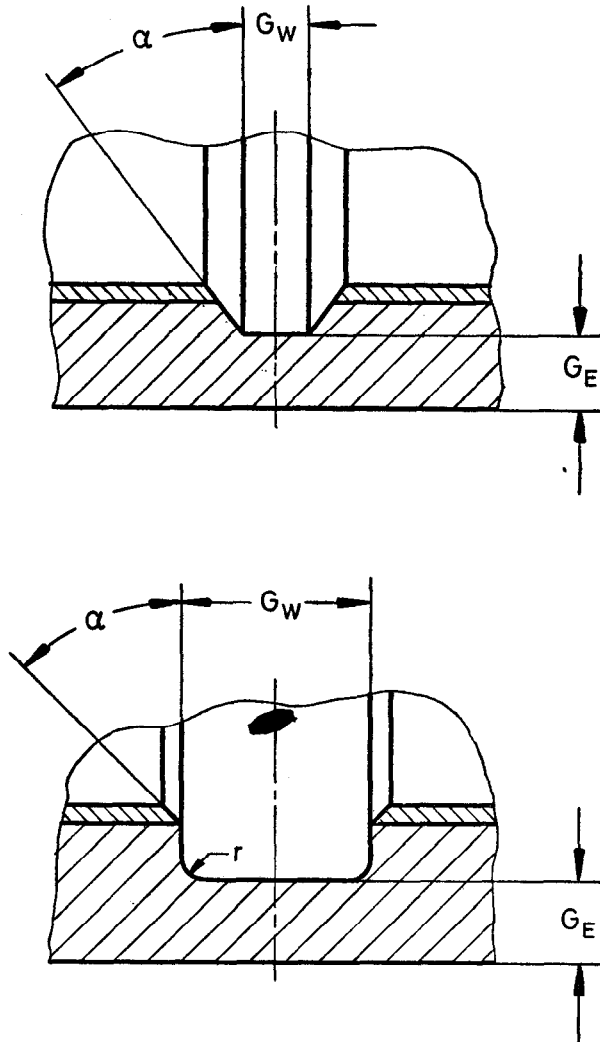
Note 2 — Tolerance on E_x — Converted into wall thickness variation in order to check it easily on finished bearings. It should be subject to agreement between the user and the manufacturer.

FIG. 5 ECCENTRIC BORE

6.3.1 Eccentric bores are not generally required in bearings having housing diameter larger than 120 mm.

6.4 Oil Grooves — Groove sizes are determined by functional requirements and are not specified in this standard.

6.4.1 Groove forms — The preferred groove forms are shown in Fig. 6.



r = Chamfer radius, to be specified,
 G_W = Groove width, to be specified,

G_E = Wall thickness at back of groove, to be specified, and
 Angles of $\alpha = 30^\circ$ and 45° are most frequently used.

FIG. 6 GROOVE FORMS

TABLE 7 TOLERANCE ON WALL THICKNESS AT BACK OF GROOVE

(Clause 6.4.3.1, and Fig. 6)

All dimensions in millimetres.

Housing Diameter D_L		Tolerance on G_E
Above e	Up to and Including	
—	120	+ 0.20 0
120	150	+ 0.35 0

6.4.2 Groove location — For a central annular groove, the position shall be specified as indicated in Fig. 7. The value of symmetry tolerance shall be stated in the second compartment of the tolerance frame.

6.4.3 Groove depth — The wall thickness at the back of groove G_E shall not be less than 0.7 mm or $0.35 \times e_T$, whichever is larger.

6.4.3.1 The tolerances on the wall thickness at the back of groove shall be as given in Table 7 (see Fig. 6).

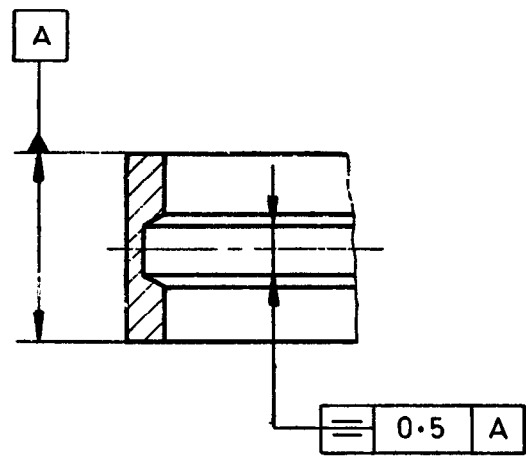


FIG. 7 SYMMERTY TOLERANCE ON GROOVES

6.5 Oil Holes — Oil holes shall usually be drilled, but may also be pierced. In both cases, the sharp edges of oil holes shall be removed.

6.5.1 For centrally positioned oil holes, tolerance shall be specified as indicated in Table 8 (see Fig. 8).

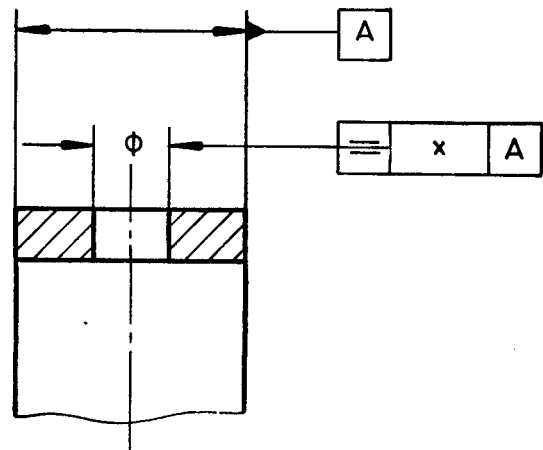


FIG. 8 SYMMETRY TOLERANCE ON OIL HOLES

TABLE 8 SYMMETRY TOLERANCE

(Clause 6.5.1, and Fig. 8)

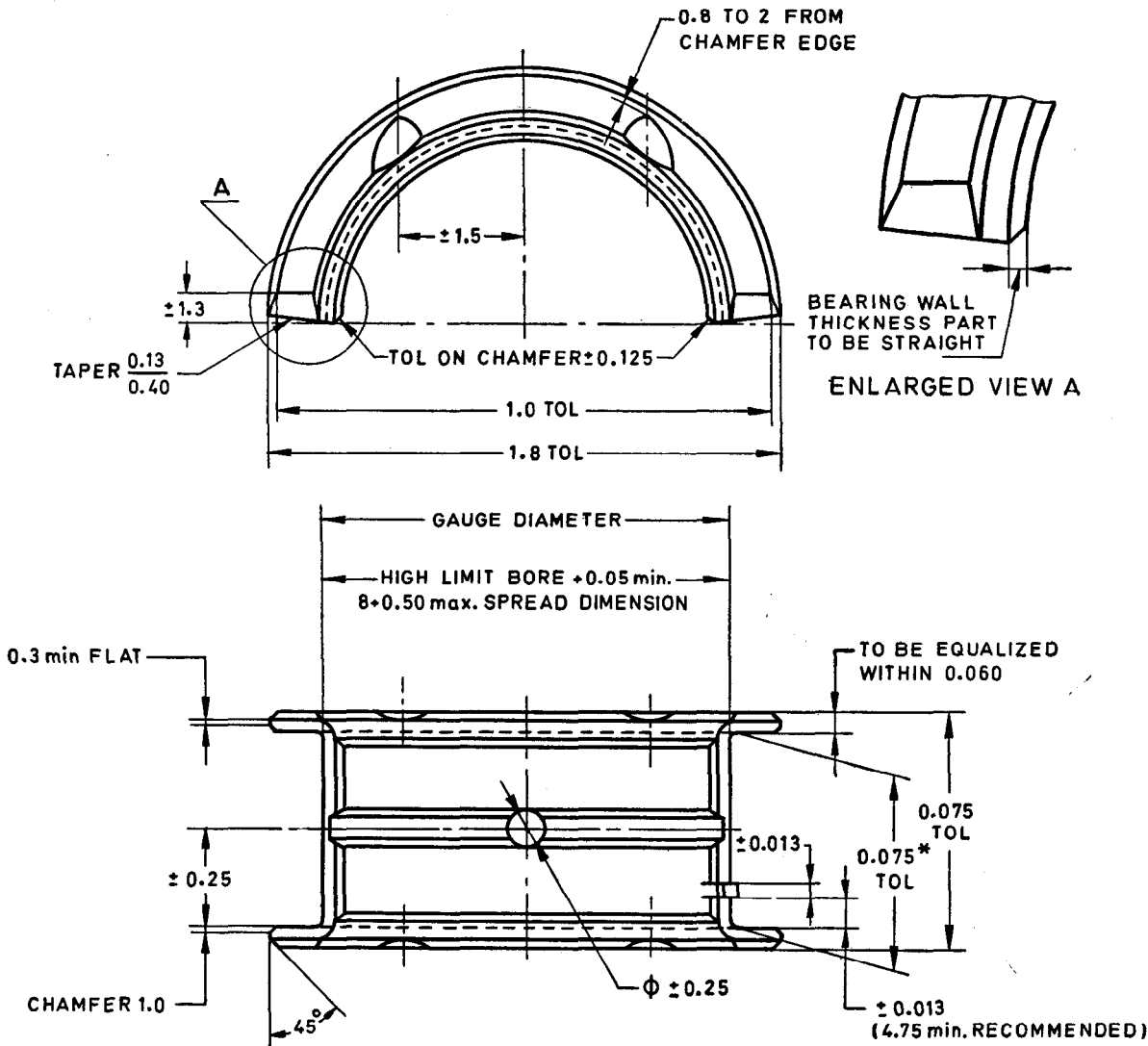
All dimensions in millimetres.

Bearing Width L		Symmetry Tolerance x
Above	Up to and Including	
— 120	120 150	0.5 1.00

6.5.1.1 Tolerances on the angular location of oil holes shall be $\pm 1^\circ$ and that for oil hole diameter shall be ± 0.25 mm. For all other cases the positions of the oil holes shall be subject to agreement between the user and the manufacturer.

6.6 Flange Bearing Width — The standard does not specify the bearing width L , since this will be determined by the application. The width tolerance on L (see Fig. 9) shall be 0.075 mm.

6.7 Flange Gap (Straddle/Bar Gauge) — This is defined as inside dimension between flanges of a double flanged bearing (see Fig. 9). This gap is measured in free state at a position just above tangent point of flange radius on bearing back. The flange gap so measured shall have a tolerance of 0.075 mm.



*Measured in free state at a position just above tangent point of flange radius on bearing back limit on angular oil hole locations $\pm 1^\circ$ all other angles $\pm 2^\circ$

All dimensions in millimetres.

FIG. 9 TOLERANCE ON FLANGED BEARINGS

6.8 Flange Thickness

6.8.1 The thickness of two flanges shall be equalized within 0.060 mm.

6.8.2 Flange Thickness Taper (Out of Parallelism of Sides of Flanges) — The variation in flange thickness which may be stated as flange thickness taper or out of parallelism of the sides of a flange, shall not exceed 0.032 mm when measured from the body diameter (flange back outer diameter) to the flange tip.

6.9 Flange Joint Face (Parting Line) Taper — Radial relief is provided on flanges to prevent extreme pressure on flange parting line during assembly. For flange taper details and tolerances (see Fig. 9).

Note — The relief is not necessary for single flange but is essential for flanges when used in pairs.

6.10 Flange Thrust Face Relief and Joint Faces (Parting Line) — This relief is provided to ensure satisfactory alignment of two faces at the joint and also to prevent scraping of oil film on thrust face of journal. The details and tolerances shall be as shown in Fig. 10.

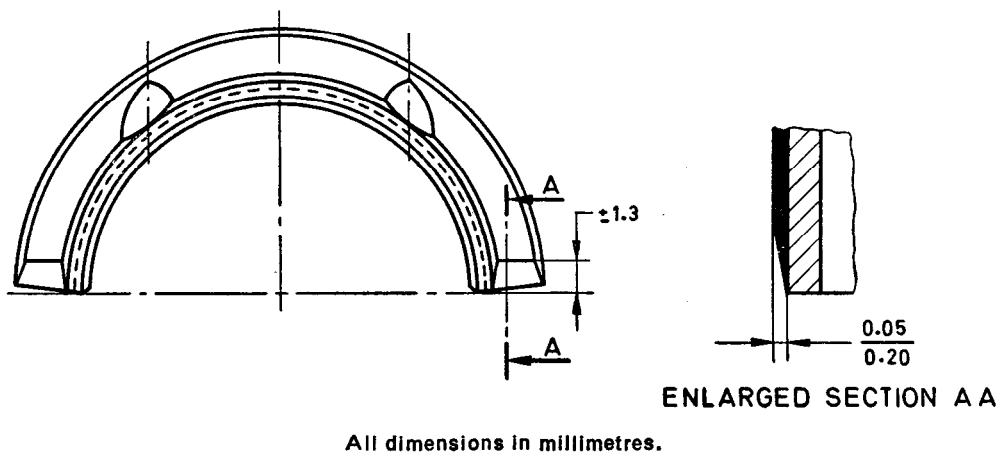


FIG. 10 FLANGE THRUST FACE RELIEF

6.11 Flange Root Shape

6.11.1 Undercut at flange root — This feature is essential for flange bearings to be used with chamferless housing. The alternative forms of undercut in use are shown in Fig. 11. The size of undercut is usually 1.5 mm wide and 0.2 to 0.4 mm deep.

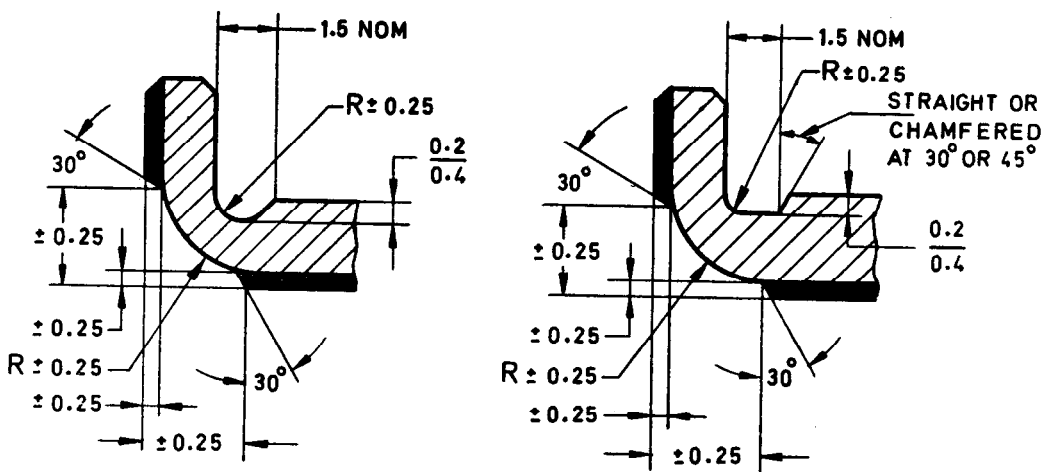
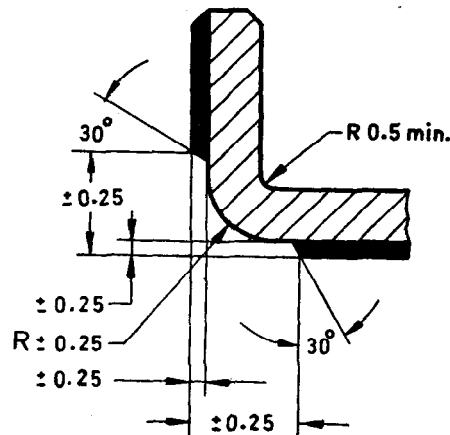


FIG. 11 UNDERCUT AT FLANGE ROOT

6.11.2 Radius at flange root—For flanges which are formed by rolling or pressing, having very thick cross-sectional area at flange root, a radius instead of undercut is preferred at flange root (see Fig. 12). The radius is usually 0.5 mm or can be optional depending on actual size of chamfer provided on housing. However, it is essential to provide positive chamfer, greater than the flange root radius, on housing inside diameter so that there is no interference of flange root radius, while fitting the flange bearing into housing.



All dimensions in millimetres.

FIG. 12 RADIUS AT FLANGE ROOT

6.12 Flange Bearing Inside Diameter Chamfer Details—The flange inside diameter chamfer radius shall be of appropriate size that will clean up loose material from rounded inner ends and blend with bore. Flange face with 30° angle blending with flange face shall be greater than bore diameter by at least 0.25 mm (see Fig. 12).

6.13 Flange Outside Diameter—The maximum flange outside diameter size shall not be larger than 1.3 times the housing diameter.

7. Flange Face Finish and Lining Thickness—Due to manufacturing processes the flange will have few hairline cracks running radially across the faces. These shall be in the alloy lining only and shall not affect the bond or the steel backing.

7.1 The alloy lining thickness on flange face vary across the face in case of majority of flange bearings. Nearest to the bore will be thinnest lining and thickest will be approximately at mean diameter of flange and will decrease towards the periphery of the flange.

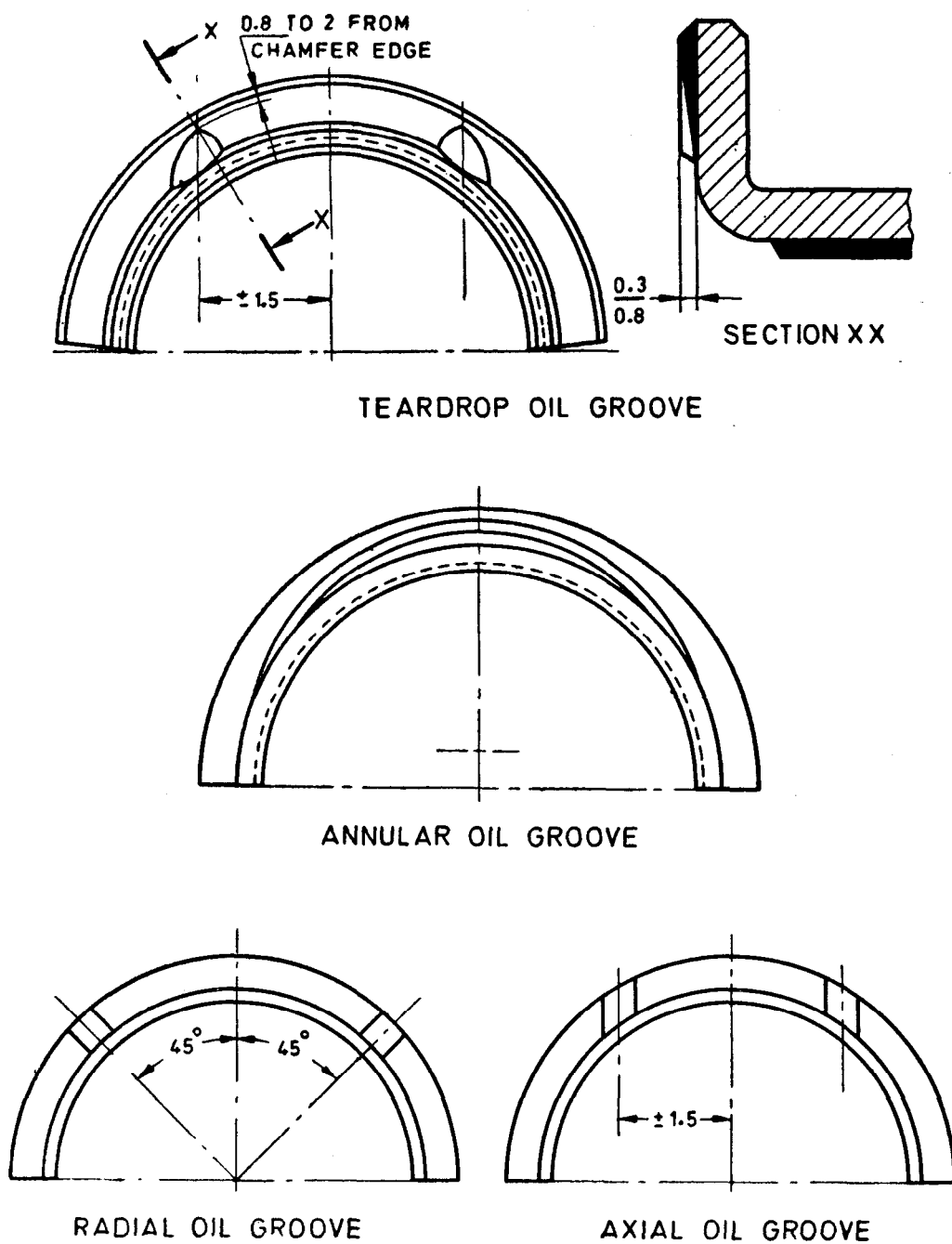
8. Free Spread on Flange Bearing—The free spread of flange bearings shall be 0.05 mm absolute minimum and 0.4 mm maximum.

9. Oil Grooves on Thrust Faces—The purpose of oil grooves is to lubricate the thrust faces. Fig. 13 illustrates some of the typical patterns/types of oil grooves used for flange bearing thrust faces.

10. Designation—Flange bearings shall be designated by preferred housing diameter, wall thickness, bearing alloy lining material and the number of this standard. A prefix 'F' shall be added to denote the part as flange bearing.

10.1 A letter indicating special features of bearing lining material shall be suffixed to the designation in the following cases:

Lining Material				Suffix
White metal, tin-based	...	...	...	WM
White metal, lead-based	...	...	...	WML
Copper-based alloy (unplated )	...	...	...	CL
Copper-based alloy (plated )	...	...	...	CL (P)
Aluminium-based alloy (unplated )	...	...	...	AL
Aluminium-based alloy (plated )	...	...	...	AL (P)
Any other material	...	...	...	SP (SP to denote any other material)



All dimensions in millimetres.

FIG. 13 VARIOUS PATTERNS OF OIL GROOVES ON THRUST FACES

10.2 A flange bearing having housing diameter 40 mm and wall thickness 2 mm using lining as aluminium alloy, unplated shall be designated as under:

Thinwalled Flanged Half Bearing F-40-2'00-AL IS : 4774

11. Marking— The bearing shall be clearly and indelibly marked with the preferred housing diameters and wall thickness away from the crown of the bearing and as near to the joint faces as practicable. The manufacturer's trade-mark or symbol together with the customers' part number shall be marked on the back of the liner. The marking shall not interfere through burring or distortion, with the press fit of the running clearance.

11.1 In case of undersize bearing, the repair size shall be clearly and indelibly marked close to the designation on the bearing half-liner in hundredths of millimetre in the following manner:

Amount of reduction 0.25, 0.50, 0.75, 1.00, 1.25, etc
RS I, RS II, RS III, RS IV, RS V, etc where 'RS' represents repair size

11.2 ISI Certification Marking — Details available with the Indian Standards Institution.

12. Packing — The bearings shall be flashed with tin, lead-tin or lead-indium, and coated with anti-corrosive grease or oil. The packaging shall be subject to an agreement between the purchaser and the supplier.

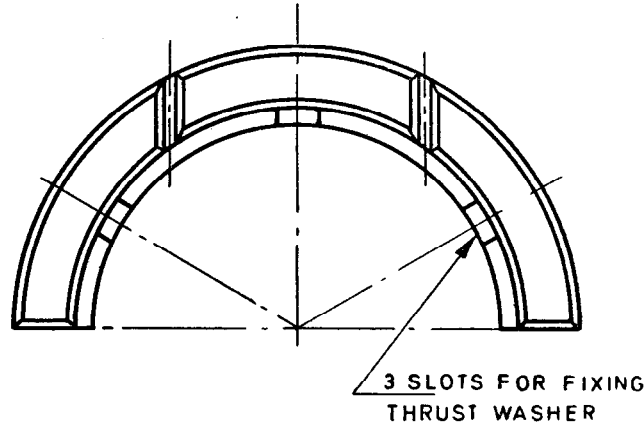


FIG. 14 CLIP-ON TYPE FLANGE BEARING DESIGN

APPENDIX A

(Clause 3.1)

COMPOSITION OF LINING MATERIAL

Lining	Approximate Percentage of					
	Sn	Sb	Cu	Pb	As	
<i>Tin-based White Metal</i>						
a) Sn Sb8 Cu4	88-90	7-8	3-4	0.35 Max	0.1 Max	
	Sn	Sb	Cu	Pb	As	
<i>Lead-based White Metal</i>						
a) Pb Sb10 Sn6	5-7	9-11	0.7 Max	80-86	0.25 Max	
b) Pb Sb15 Sn10	9-11	14-16	0.7 Max	71-77	0.6 Max	
c) Pb Sb15 Sn As	0.9-1.7	13.5-15.5	0.7 Max	80-84	0.8-1.2	
	Sn	Cu	Pb			
<i>Copper-based Alloys</i>						
a) Cu Pb 30	0.5 Max	*R	26-33			
b) Cu Pb24 Sn4	3-4.5	*R	19-27			
c) Cu Pb8 Sn4	3.5-4.5	*R	7-9			
	Al	Cu	Sn	Ni	Si	Mn
<i>Aluminium-based Alloys</i>						
a) Al Sn20 Cu	*R	0.7-1.3	17.5-22.5	0.1 Max	0.7 Max	0.7 Max
b) Al Sn6 Cu	*R	0.7-1.3	5.5-7	1.3	0.7 Max	0.7 Max
	Pb	Sn	Cu			
<i>Overlays</i>						
a) Pb Sn10	*R	8-12	—			
b) Pb Sn10 Cu2	*R	8-12	1-3			

*Remainder.

APPENDIX B

(Clause 3.1)

COMPOSITION OF STEEL BACKING MATERIAL

Chemical / Physical Analysis

Carbon	(C)	0.08 - 0.10 Max
Manganese	(Mn)	0.50 Max
Silicon	(Si)	0.35 Max
Sulphur	(S)	0.05 Max
Phosphorus	(P)	0.05 Max
Hardness	(HV10)	75 - 95 VPN

Alternate

Carbon	(C)	0.12 Max
Manganese	(Mn)	0.5 Max
Silicon	(Si)	0.35 Max
Sulphur	(S)	0.05 Max
Phosphorus	(P)	0.05 Max
Hardness	(HV10)	100 - 120 VPN

The steel strips should be cold rolled, fully bright, annealed; free from pits, roaks, laps, lamination throughout, and inclusions of foreign particles.

EXPLANATORY NOTE

This standard was earlier published by Rolling Bearing Sectional Committee, EDC 39. Consequently, on the setting up of Plain Bearing Sectional Committee, EDC 80, this subject was transferred from EDC 39 to EDC 80. At the time of periodic review, the concerned committee felt the need of revising the specification in line with current international practice.

This specification has been divided in two parts. Part I covers plain bearings and Part II covers flange bearings.

The flange half liners which are formed from pressed bimetallic strips are generally limited to housing inside diameters from 38 mm to 150 mm.

New Developments in Flange Construction — Flange bearings manufactured by pressing or casting, have integral flanges and as such, they have same bearing alloy for bearing bore and thrust face. With new manufacturing techniques developed recently, it is possible to manufacture flange bearings by attaching thrust washers at both or either end of plain journal bearing. The following two types of flange bearing construction are recently in use.

a) **Clip-on Flanges** — Plain journal bearing and half thrust washers are provided with slots and lugs respectively and these are interference fitted into each other to form flanged bearing. The Fig. 14 illustrates typical construction of clip-on type flange designs.

This design gives flexibility of using dissimilar bearing alloy for flange thrust faces.

b) **Interference Fitted Flanges** — In this design of flange bearing, the thrust washer internal diameter is kept interference fit on plain journal bearing outside diameter and these two are pressed together to form flange bearing. However, this design is limited to applications where plain bearing thickness is appreciable to provide necessary rigidity for interference fit of thrust washer to be mounted on to it.

AMENDMENT NO. 1 JANUARY 1996
TO
IS 4774 (Part 2) : 1982 SPECIFICATION FOR
THIN-WALLED HALF BEARING
PART 2 FLANGED BEARING

(First Revision)

(Page 2, Table 2) — Substitute the following for the existing table:

Housing Diameter D_L		Tolerance on e_T ($e_{TMax} - e_{TMin}$)	
Above	Up to and Including	As Machined	As Plated
—	75	0.008	0.012
75	100	0.010	0.014
100	120	0.012	0.016
120	200	0.017	0.024